Tc-99 Investigation at INTEC

Phase I Results

December 18, 2003

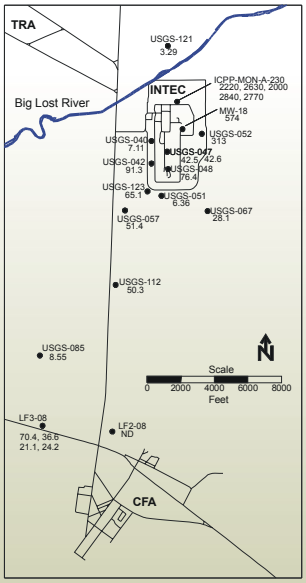
Idaho Completion Project

Bechtel BWXT Idaho, LLC

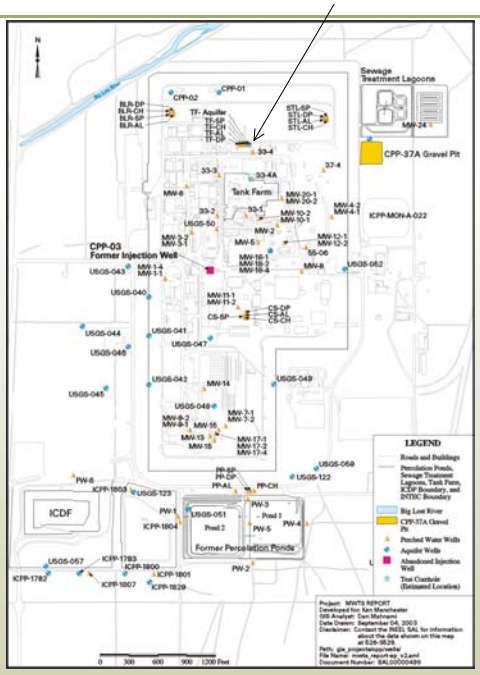
Background Information

- *Tc-99 detected in well Tank Farm Aquifer Well (ICPP-MON-A-230) during routine sampling*
  - *Tc-99 = 2,220 pCi/L (2,110 pCi/L in duplicate) in sample from 5/13/03*
  - *Re-sampling on 8/11/03 confirmed the May results*
  - *EPA & IDEQ notified on 8/14/03*
- *Drinking water MCL for Tc-99 is 900 pCi/L*
- *INTEC drinking water results: Non-detect (<3.23 pCi/L)*
- *INTEC raw (process) water results:*
  - *2001 raw water sampling results: 23.6 pCi/L (CPP-01 & -02 blend)*
  - *1995 raw water wells: CPP-01 = 31 pCi/L; CPP-02 = 1.1 pCi/L*

2003 Tc-99 Distribution in Groundwater



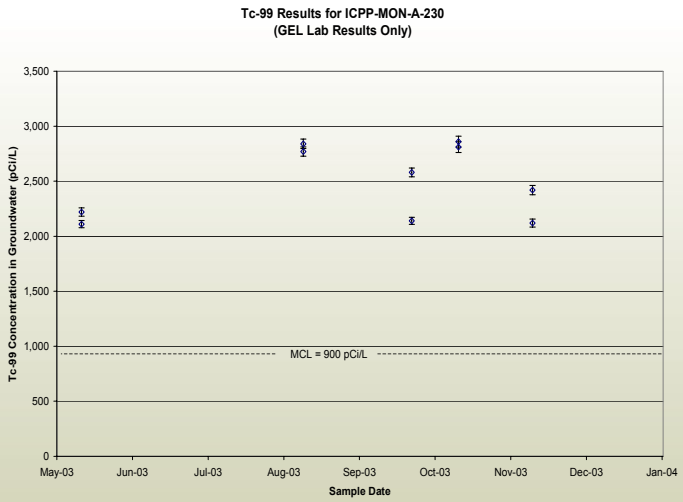
Tank Farm Aquifer Well



Completed Phase I Tasks:

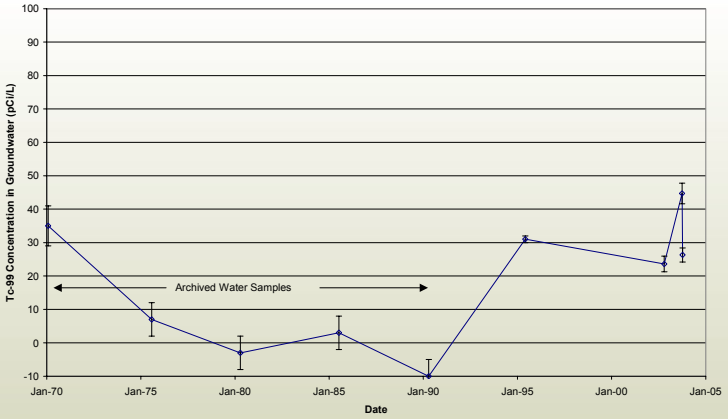
- *Supplemental Tc-99 Work Plan*
- *Monthly groundwater sampling of TF-Aquifer Well*
- *Raw water sampling at CPP-1 and CPP-2*
- *Archived water sample analysis from selected INTEC wells for Tc-99*
- *Perched water & lysimeter sampling*
- *Evaluation of TF-Aquifer Well construction*
- *Review vadose zone stratigraphy*
- *Neutron logging and colloidal borescope logging of TF-Aquifer Well*
- *Pumping test at TF-Aquifer Well*
- *Core sampling and analysis*
- *Capture zone analysis of INTEC supply wells*
- *Evaluation of Tc-99 source(s) at INTEC*

Monthly Groundwater Sampling Results



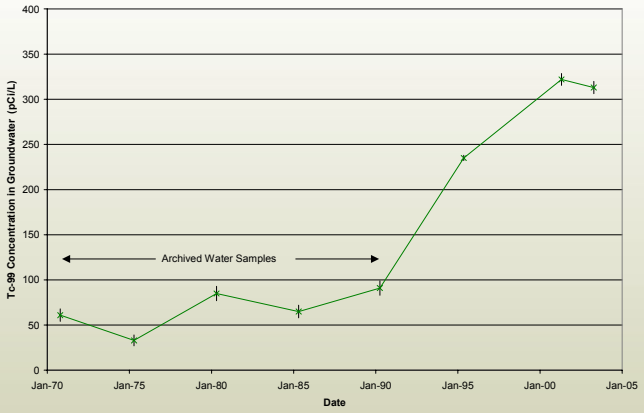
Raw Water Sampling Results
(Well CPP-01 located 600 feet NW of TF Aquifer Well)

Tc-99 Results for CPP-01 Raw Water Well



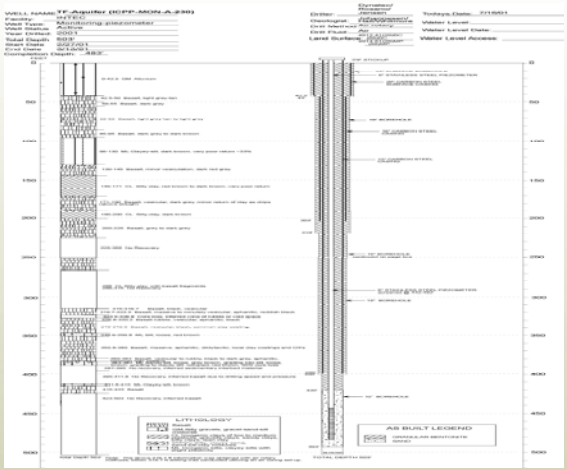
Archived Water Tc-99 Results for USGS-52
(located 1500 feet SE of TF Aquifer Well along eastern INTEC fenceline)

Tc-99 Results for USGS-52

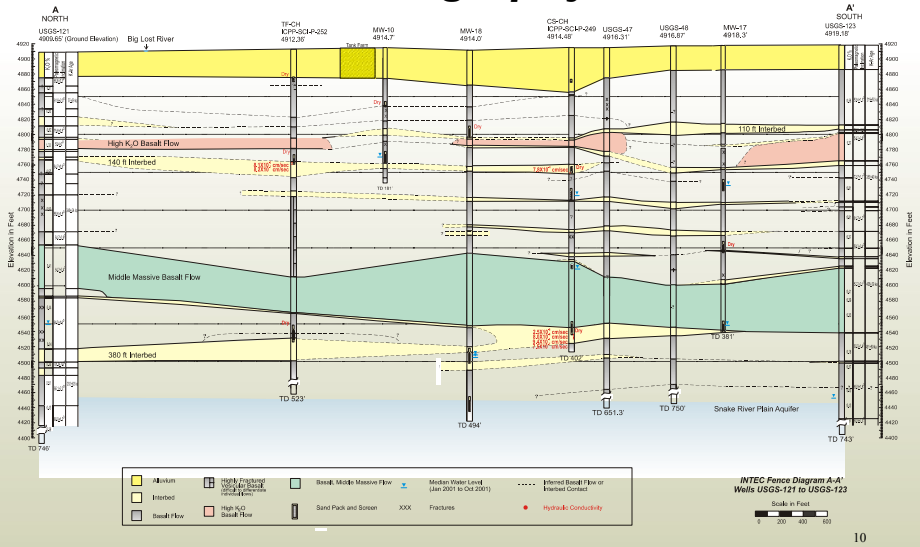


Evaluation of TF-Aquifer Well construction

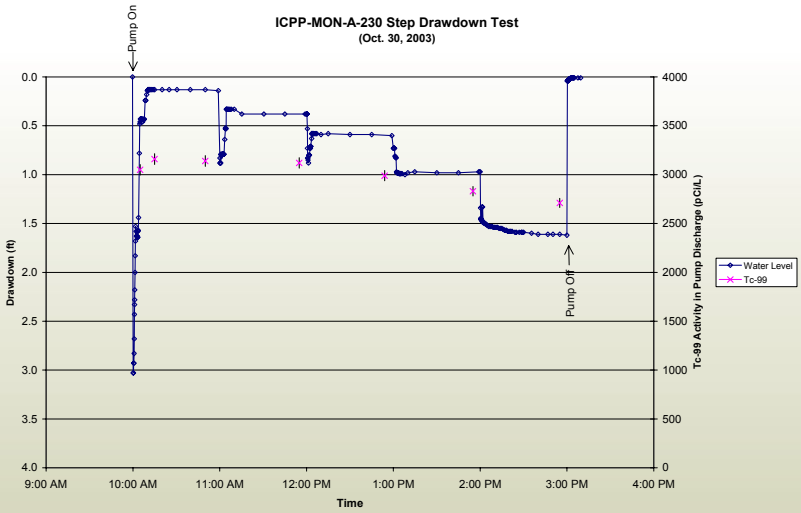
- *Telescoped construction minimizes potential for cross-contamination*
- *No evidence that Tc-99 was carried down during drilling*



Vadose Zone Stratigraphy



Pumping Test at TF-Aquifer Well



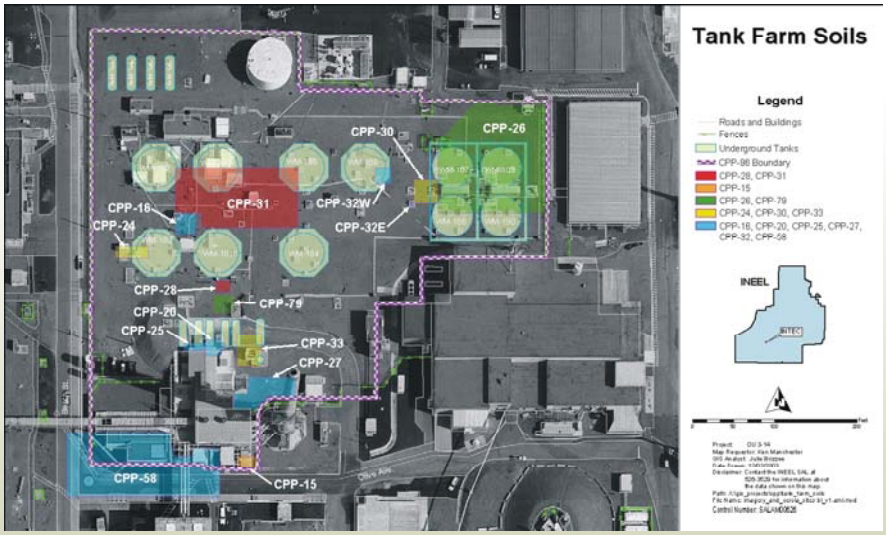
Pumping Test Results

- *Over 16,000 gallons of groundwater pumped during the 5-hour pumping test*
- *Aquifer is highly permeable at this location (K=4000 ft/day)*
- *Tc-99 concentrations declined slightly with higher pumping rates*
- *Persistence at concentrations above 2000 pCi/L indicates that Tc-99 is present over a substantial volume of the aquifer*

Evaluation of potential Tc-99 source(s) at INTEC

- *Ratios of Tc-99, H-3, and nitrate in groundwater and waste streams were used to "fingerprint" various sources of Tc-99*
- *Contaminant ratios at TF Aquifer Well resemble those in past releases in the vicinity of the Tank Farm (i.e. CPP-31, CPP-28, CPP-79)*
- *Contaminant ratios at other INTEC monitor wells resemble ratios in the Service Waste that was previously sent to the former injection well*
- *Dilute Tc-99 plume downgradient of INTEC probably largely attributable to Service Waste discharge to aquifer at the former injection well*

Ratio	Average Aquifer Well	TF Aquifer Well	Combined CPP-28/31 Release
H-3/Tc-99	100	1.7	2.2
NO3/H-3 (g/µCi)	0.1	8.1	4.7
NO3/Tc-99 (g/µCi)	100	14	10



Summary of Phase I Results

- *Tc-99 in SRPA is not attributable to downhole cross-contamination from installation of the MON-A-230*
- *Tc-99 was not detected in core samples*
- *Aquifer is very permeable at this location*
- *Tc-99 appears to have been present in the SRPA beneath northern portion of INTEC for many years*
- *Most likely source of the Tc-99 in the groundwater in the vicinity of this monitor well appears to be from past releases that occurred at the Tank Farm.*
- *Most likely mechanism for transport of Tc-99 to the aquifer is downward movement of contaminated water through the vadose zone to the water table*
- *Former INTEC injection well likely constituted an earlier source of Tc-99 to the aquifer; but groundwater concentrations were far below the MCL*

Idaho Completion Project

Bechtel BWXT Idaho, LLC

Tc-99 Phase II Investigation and Path Forward

Tc-99 Phase II Path Forward

- *Phase II performed under OU 3-13 Group 4 Perched Groundwater*
  - *Likely source of contamination is perched groundwater*
  - *Established Remedial Action Objectives*
    - *Meet groundwater cleanup standards in the SRPA at the INTEC perimeter fence by 2095*
  - *Similar scope and DQOs as existing work plan [Group 4 Monitoring System/Installation Plan (MSIP)]*

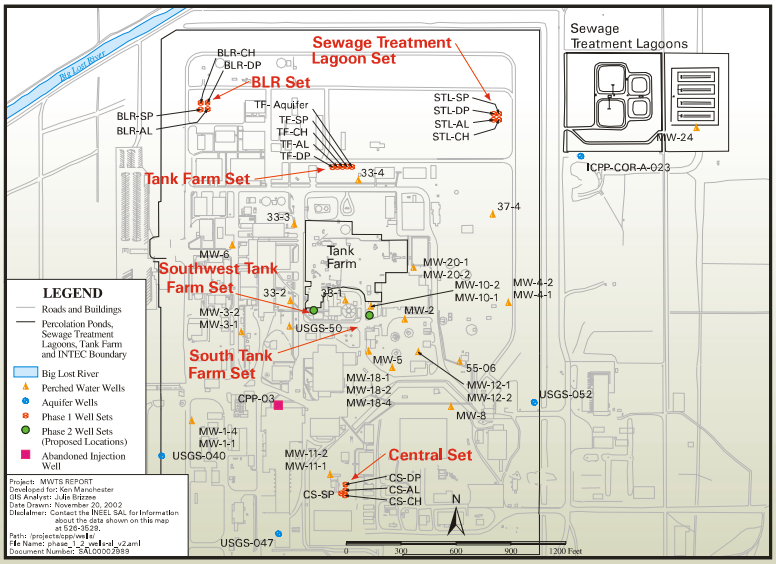
Tc-99 Phase II Scope

Scope

- *Two new well sets south of tank farm (described in MSIP)*
  - *Shallow perched, deep perched, and aquifer skimmer well*
- *Groundwater sampling and analysis (described in MSIP)*
- *Colloidal borescope survey (new scope to MSIP)*

Satisfies existing Group 4 DQOs

- *COC flux to the SRPA reduced following the percolation pond relocation to meet SRPA MCL's by 2095?*



Proposed Phase II well locations

Other Projects Supported by Tc-99 Phase II Investigation

- *Group 4 Perched Groundwater*
  - *Perched water impacts to the SRPA*
- *OU 3-14 Tank Farm RI/FS*
  - *Model calibration*
  - *Groundwater impacts*
  - *Future monitoring*
- *INTEC Final Groundwater Decision*
  - *Wells sited in expected highest contamination areas*

Group 4 with Tc-99 Phase II Schedule

- FY04
  - Complete modifications to Group 4 MSIP
  - Prepare drilling bid package
- FY05
  - Work planning and well siting
  - Well drilling and installation
  - Colloidal borescope survey
- FY06 – FY07
  - Groundwater Monitoring
  - Update WAG 3 Vadose Zone Numerical Model
- FY08
  - Finalize Group 4 Monitoring Report/Decision Summary

Idaho Completion Project

Bechtel BWXT Idaho, LLC

Tc-99 Supporting Information

- *Tc-99 information:*
  - *Fission product present in SNF*
  - *Half life: 212,000 yrs*
  - *Relatively mobile in water as pertechnetate anion (TcO_4^-) (similar to I-129 and tritium)*
- *First Tc-99 monitoring of aquifer in 1991-92 by USGS:*
  - *Showed ~53 square mile Tc-99 plume map extending from ICPP to beyond south INEEL boundary near Big Southern Butte*
  - *Estimated a total of ~15 Ci Tc-99 in the aquifer*
  - *Concluded that Tc-99 behaves conservatively during transport in SRPA*
- *MON-A-230 well construction information:*
  - *Location:*
    - *300 feet north of Tank Farm northern fence*
    - *750 feet inside the northern INTEC fence*
  - *Installed 2001 to a total depth of 503 feet (screened 443'-483')*
  - *Depth to water: 463 feet on 5/13/03 (skimmer well)*
  - *First groundwater sample collected May 13, 2003*

Summary of Tc-99 Concentrations in Groundwater

Well	Sample Date	Sample Collected by	Laboratory	Tc-99 Concentration (pCi/L)	Uncertainty (pCi/L, ± 1 sigma)	MDA (pCi/L)
MON-A-230	05/13/03	INEEL	GEL	2,220	37.7	16.0
MON-A-230	05/13/03	INEEL	GEL	2,110[a]	32.4	6.75
MON-A-230	08/11/03	INEEL	GEL	2,840	43.4	8.18
MON-A-230	08/11/03	INEEL	GEL	2,770[a]	42.2	7.94
MON-A-230	08/11/03	INEEL	STL	2,630	260	3.0
MON-A-230	08/11/03	INEEL	STL	2,000	200	1.0
MON-A-230	08/11/03	USGS	RESL	2,340 2,290[b]	10 110	NR NR
MON-A-230	08/11/03	USGS	ISU	2,417	4.3	NR
MON-A-230	09/24/03	INEEL	GEL	2,580	40.0	19.1
MON-A-230	09/24/03	INEEL	GEL	2,140[a]	31.7	13.8
MON-A-230	10/13/03	INEEL	GEL	2,810	48.9	15.6
MON-A-230	10/13/03	INEEL	GEL	2,860[a]	49.8	15.7
MON-A-230	10/13/03	INEEL	RESL	2,460	10	NR
MON-A-230	10/13/03	INEEL	RESL	2,350[a]	10	NR
MON-A-230	11/12/03	INEEL	GEL	2,420	42.0	16.8
MON-A-230	11/12/03	INEEL	GEL	2,120[a]	36.9	16.2
CPP-1	10/02/03	INEEL	GEL	44.7	3.09	7.87
CPP-1	10/13/03	INEEL	GEL	26.3	2.10	6.07
CPP-2	10/13/03	INEEL	GEL	0.797	1.45	4.84

a. Field duplicate.
b. Lab duplicate (repeat analysis).

Note: Values shown in gray shading are preliminary (unvalidated) results that may be revised.

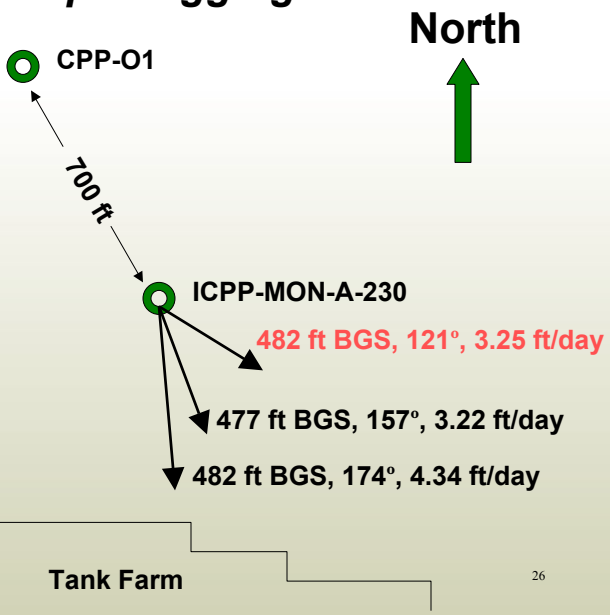
Abbreviations:
MDA = minimum detectable activity
NR = not reported or unknown
GEL = General Engineering Laboratories, Charleston, South Carolina
INEEL = Idaho National Engineering and Environmental Laboratory
ISU = Idaho State University
RESL = Radiological and Environmental Sciences Laboratory, INEEL
STL = Severn-Trent Laboratories, St. Louis, Missouri
USGS = U.S. Geological Survey

Radionuclide Results for TF Aquifer Well

Radionuclide	Sample Result	Sample Error	Validation Flag	Sample Units	Sample Date
Americium-241	-0.01	0.00	U	PCI/L	05/13/2003
Americium-241	0.01	0.01		PCI/L	10/13/2003
Americium-241	0.02	0.02		PCI/L	10/13/2003
Carbon-14	1.27	1.12	U	PCI/L	05/13/2003
Carbon-14	0.69	0.90	U	PCI/L	05/13/2003
Cerium-144	-4.75	7.07	U	PCI/L	05/13/2003
Cerium-144	8.41	9.76		PCI/L	10/13/2003
Cerium-144	-0.37	7.38		PCI/L	10/13/2003
Cesium-134	-1.48	1.13	U	PCI/L	05/13/2003
Cesium-134	-1.69	1.49		PCI/L	10/13/2003
Cesium-134	-0.45	1.71		PCI/L	10/13/2003
Cesium-137	0.53	0.96	U	PCI/L	05/13/2003
Cesium-137	-0.54	1.40		PCI/L	10/13/2003
Cesium-137	8.20	5.94		PCI/L	10/13/2003
Cobalt-60	-2.61	1.22	U	PCI/L	05/13/2003
Cobalt-60	0.83	1.19		PCI/L	10/13/2003
Cobalt-60	-0.29	1.49		PCI/L	10/13/2003
Europium-152	-0.32	2.79	U	PCI/L	05/13/2003
Europium-152	0.72	4.00		PCI/L	10/13/2003
Europium-152	7.70	3.89		PCI/L	10/13/2003
Europium-154	3.19	2.50	U	PCI/L	05/13/2003
Europium-154	9.07	3.64		PCI/L	10/13/2003
Europium-154	-3.41	3.70		PCI/L	10/13/2003
Europium-155	-3.12	4.07	U	PCI/L	05/13/2003
Europium-155	-0.98	5.46		PCI/L	10/13/2003
Europium-155	-4.99	4.41		PCI/L	10/13/2003
Gross Alpha	32.70	2.72	J	PCI/L	05/13/2003
Gross Alpha	92.00	5.66		PCI/L	10/13/2003
Gross Alpha	61.50	3.95		PCI/L	10/13/2003
Gross Beta	931.00	19.10	J	PCI/L	05/13/2003
Gross Beta	1220.00	9.30		PCI/L	10/13/2003
Gross Beta	1120.00	7.46		PCI/L	10/13/2003
Iodine-129	0.12	0.03		PCI/L	05/13/2003
Iodine-129	0.08	0.04	U	PCI/L	10/13/2003
Iodine-129	0.03	0.05	U	PCI/L	10/13/2003
Manganese-54	-0.17	0.94	U	PCI/L	05/13/2003
Manganese-54	1.55	1.13		PCI/L	10/13/2003
Manganese-54	-0.08	1.48		PCI/L	10/13/2003
Neptunium-237	0.02	0.04	U	PCI/L	05/13/2003
Neptunium-237	0.01	0.01		PCI/L	10/13/2003
Neptunium-237	-0.03	0.02		PCI/L	10/13/2003
Plutonium-238	-0.01	0.00	U	PCI/L	05/13/2003
Plutonium-238	0.00	0.01		PCI/L	10/13/2003
Plutonium-238	-0.01	0.01		PCI/L	10/13/2003
Plutonium-239/240	0.00	0.01	U	PCI/L	05/13/2003
Plutonium-239/240	0.08	0.04		PCI/L	10/13/2003
Plutonium-239/240	-0.02	0.01		PCI/L	10/13/2003
Plutonium-241	-0.28	1.68	U	PCI/L	05/13/2003
Plutonium-241	-2.27	2.77		PCI/L	10/13/2003
Plutonium-241	-2.69	3.02		PCI/L	10/13/2003
Potassium	4420.00			UG/L	05/13/2003
Potassium	4480.00			UG/L	05/13/2003
Radium-226	0.34	0.17		PCI/L	10/13/2003
Radium-226	0.88	0.24		PCI/L	10/13/2003
Radium-228	-0.26	0.20		PCI/L	10/13/2003
Radium-228	-0.09	0.23		PCI/L	10/13/2003
Ruthenium-106	-7.58	8.02	U	PCI/L	05/13/2003
Ruthenium-106	-17.80	11.20		PCI/L	10/13/2003
Ruthenium-106	9.75	13.50		PCI/L	10/13/2003
Silver-108m	-0.88	0.99	U	PCI/L	05/13/2003
Silver-108m	-1.39	1.22		PCI/L	10/13/2003
Silver-108m	-1.08	1.39		PCI/L	10/13/2003
Silver-110m	-0.40	0.87	U	PCI/L	05/13/2003
Silver-110m	-0.11	1.34		PCI/L	10/13/2003
Silver-110m	1.33	1.44		PCI/L	10/13/2003
Strontium-90	7.61	1.05		PCI/L	05/13/2003
Strontium-90	8.06	1.06		PCI/L	10/13/2003
Strontium-90	9.76	1.09		PCI/L	10/13/2003
Technetium-99	2110.00	32.40		PCI/L	05/13/2003
Technetium-99	2220.00	37.70		PCI/L	05/13/2003
Technetium-99	2840.00	43.40		PCI/L	08/11/2003
Technetium-99	2770.00	42.20		PCI/L	08/11/2003
Technetium-99	2580.00	40.00		PCI/L	09/24/2003
Technetium-99	2140.00	31.70		PCI/L	09/24/2003
Technetium-99	2810.00	48.90		PCI/L	10/13/2003
Technetium-99	2860.00	49.80		PCI/L	10/13/2003
Uranium-233/234	1.91	0.22		PCI/L	05/13/2003
Uranium-233/234	1.83	0.21		PCI/L	10/13/2003
Uranium-233/234	1.88	0.21		PCI/L	10/13/2003
Uranium-235	0.19	0.05		PCI/L	05/13/2003
Uranium-235	0.21	0.05		PCI/L	10/13/2003
Uranium-235	0.04	0.02		PCI/L	10/13/2003
Uranium-238	1.00	0.14		PCI/L	05/13/2003
Uranium-238	1.32	0.16		PCI/L	10/13/2003
Uranium-238	1.33	0.16		PCI/L	10/13/2003
Zinc-65	-2.98	2.19	U	PCI/L	05/13/2003
Zinc-65	-3.33	2.45		PCI/L	10/13/2003
Zinc-65	6.53	3.06		PCI/L	10/13/2003

Yellow shaded cells represent preliminary unvalidated data; results could change during data validation.

Colloidal Borescope Logging Results (Days 1 and 2)



Capture zone analysis of INTEC supply wells